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Toward Basic Interaction Design

"WHERE ARE THE ARTISTS?!" ASKED HIROSHI ISHII, A PROFESSOR AT MIT MEDIA LAB, ADDRESSING A PANEL AT THE 2008 CONFERENCE ON HUMAN FACTORS IN COMPUTING SYSTEMS, THIS YEAR ENTITLED ART.SCIENCE.BALANCE[1]. THE QUESTION REFLECTED THE OVERALL ATMOSPHERE OF THE EVENT AND REFERRED TO MORE GENERAL ISSUES OF AESTHETICS WHICH ARE BURIED BY PROBLEMS OF EVALUATION, FUNCTIONALITY, AND MORE RECENTLY, SOCIAL ISSUES. THE AESTHETIC ASPECTS OF AN INTERACTIVE EXPERIENCE ARE OFTEN SEEN AS RESULTS OF AN ARTISTIC MOMENT OF CREATIVITY. THIS ESSAY EXPLORES A DIFFERENT APPROACH –ONE THAT DRAWS FROM A STRUCTURED INVESTIGATION OF THE DESIGN MATERIALS THAT CONTRIBUTE TO AN AESTHETIC EXPERIENCE.

The gap between the design of the user experience and the design of the artifact

Human-computer interaction (HCI) research encompasses a wide range of practices, from the development of screen-based interfaces to the design of physical products and services. Today, much of its research focus is on solving new technological problems or on the evaluation of user interaction in various social and cultural contexts. This research is largely technologically driven and socially concerned, but it neglects the aesthetic choices that seem essential for seamless everyday interactions.

Existing tools for forecasting use, such as participatory methods, "should not be confused with basic design questions and the need for methods for designers to develop a deep understanding of the appearance in use, expressions, and aesthetics of the computational object itself" argued Maze and Redström[2]. Such forecasting methods often lead to the omission of the object in its physical manifestation. Such an omission (or, likewise a substitution with a low-tech prototype at different stages of the process) may lead to the aesthetic aspects of the interaction being overlooked.

1. Prof. Ishii asked this question to the panelist in the session called "Usability Evaluation Considered Harmful" at CHI2008, the conference of the Special Interest Group on Computer-Human Interaction of the Association for Computing Machinery. For more information visit http://sigchi.org/

2. Maze, R. and Redström, J. (2005), 'Form and the Computational Object', Journal for Digital Creativity 16(1).

"Designers should have knowledge of how to shape aesthetic interactions in a more visible, explicit, and designerly way. This is a kind of knowledge we are currently missing in HCI.", as Lim and colleagues have argued[3]. Like Maze and Redström, they believe that there is the divide between the design of the user experience and that of the artifact. The former is reflected in ethnographic methods and user studies while the latter often relies on product design, engineering, fashion or architecture. However, interaction design raises particular methodological questions that cannot be answered through the sum of findings and strategies borrowed from existing disciplines. What design tools do we have to close, or at least reduce, this gap?

Basic Design

Basic design originated in the kindergarten movement of the early nineteenth century and was first taught as design practice at Bauhaus School of Art and Architecture and at the Vhutemas School in Moscow[4]. It was predominantly a visual approach, based on a number of analytic and compositional exercises that allowed students to master a variety of design techniques.

Recently, various authors, including Findeli[5], have stressed its legacy for contemporary design practice and theory. Basic design investigates the theoretical, educational and methodological foundations of design, and these foundations are particularly important when a new field of practice emerges, as is the case for interaction design today. Among others, it is useful to identify three points that provide motivation for applying basic strategies to the design of interactive objects.

Firstly, basic techniques allow us to explore and to appropriate new design materials and techniques. For example, kindergarten movement educators developed methods for the identification of basic graphic elements by abstracting from real world objects[6]. Methods such as reduction and translation originated from the analysis of visual experience in terms of simple, abstract properties, such as shapes, patterns, or colors, but were later applied to other materials such as light or texture.

These abstracted elements could then be used in order to generate a desired aesthetic experience. For example, in Moholy-Nagy's classes, students would combine different materials in order to explore new design ideas focused on generating a variety of sensations of pressure, temperature, vibration and others[7]. Although based on simple design techniques, such exercises allowed to investigate complex multi-sensory experiences, in which light, time or texture become as important as visual stimuli.

Finally, basic design proposes an interdisciplinary approach to design questions, especially to understanding perception. In the early twentieth century, the Bauhaus school organized and hosted lectures by various gestalt psychologists. Its members attempted to perform "psychological tests" to identify the most frequently occurring perceptual relations between abstract properties such as those between shapes and colors[8]. This encouraged a dialogue between scientists performing experiments on visual perception and designers exploring abstract graphical elements. Today, interdisciplinary collaborations are equally important in development of new interfaces.

3. Lim, Y.-K., Stolterman, E., Jung, H. & Donaldson, J. (2007), Interaction Gestalt and the Design of Aesthetic Interactions, in 'DPPI '07: Proceedings of the 2007 Conference on Designing Pleasurable Products and Interfaces', ACM, Helsinki, Finland, p.240

4. See Khan-Magomedov, S. O. (1990) Vhutemas: Moscou, 1920-1930, Editions du Regard and Wingler, H. M. (1978), The Bauhaus: Weimar, Dessau, Berlin, Chicago. MIT Press.

5. Findeli, A. (2001), 'Rethinking Design Education for the 21st Century: Theoretical, Methodological, and Ethical Discussion', Design Issues 17(1), 5–17

6. See for example Johannes Ramsauer's Drawing Tutor (1821) in The ABC's of [triangle square circle] : the Bauhaus and Design Theory (1993) ed. Ellen Lupton and J. Abbott Miller. pp 6.

7. Moholy-Nagy, L. (1947), Vision in Motion, Paul Theobold, Chicago.

8. In the famous Kandinsky's "psychological test" from 1923, he asked participants to fill in elementary shapes with the basic colours, in order to identify a perceptual link between the two (5). His charlatan experiment was highly biased because it was performed on the subjects who were already well informed about Kandinsky's theories.

Interactive Object: An Interplay of Temporal and Spatial Forms

What qualities of an interactive object can be designed[9]? Maze and Redström argued that the interplay between temporal and spatial forms of a computational object should be the loci of the design process [3]. Temporal form is related to the behavioral qualities of an artifact in its use. Spatial form refers to physical properties such as: size, shape and material. Maze and Redström studied how temporal and spatial form can affect each other through a two-step methodology: first designers explored different combinations of materials. Then, they investigated these combinations in the context of use in order to explore how artifact's properties evolved over time in response to users actions i.e. how the temporal form emerged.

For example, in the project Sonic City, an interface generated sound according to different environmental and personal conditions such as light, temperature and heartbeat[10]. This interactive behavior encouraged users to move around the city in order to change their surroundings and to modify their own physical states. The designers reconsidered the spatial form of the device and created a new interface, a jacket into which different sensors can be flexibly placed. This example shows how the attention to both the designed object and its use in everyday context can stimulate new design ideas.

The temporal and behavioral aspects of an artifact, and the possibility of shaping them through computational technologies, are what differentiate basic design methods for interactive objects from those for non-augmented artifacts. Therefore, we might use the term Basic Interaction Design to describe a set of analytic and creative methods based on the relationships between the temporal and spatial properties of an interactive object. Rather than relying upon an understanding of these properties as separate elements, they can be studied as relational interplays that shape the overall experience of interaction over time[11]. As in the basic design tradition, these methods may facilitate the creation of new design concepts by engaging designers in structured explorations of interactivity, and may provide new opportunities for collaborations between scientific and design disciplines.

Interaction gestalt and its attributes

An interaction gestalt can be described as a quality which emerges in an interaction over time, and can be compared to the idea of temporal form described above. It was introduced by Dag Svanaes in order to explain the way in which users perceive interactive behavior[12]. He used basic design strategies to develop the experiments using simple screen-mouse interactions with abstract graphical elements. He showed that users' attention was focused on the behavior of the objects rather than on their visual properties. For example, a square on the screen was interpreted as an electric light switch due to its changes in the color caused by clicking on it. Svanaes concluded that "the interactive experience has gestalt properties, i.e. that its first-class objects are interaction gestalts..." (12, p. 218).

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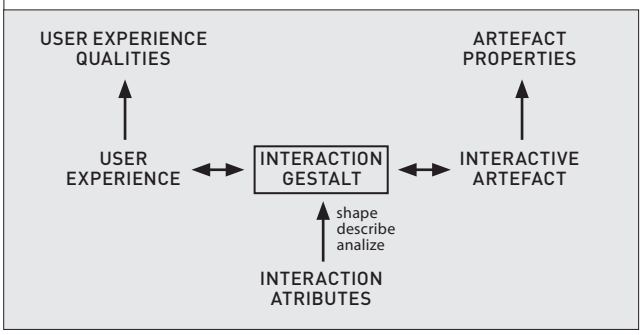

1. Interaction gestalt links the object-centered approaches to those focused on use. The diagram as reported in Lim et al (2007).

9. I would argue that social, cultural and political aspects of any object can be imagined only to a certain extend, and that the predictability of its interpretation and use is limited.

10. Gaye, L., Maze, R. and Holmquist, L. E. (2003), "Sonic city: the urban environment as a musical interface," in *NIME '03: Proceedings of the 2003 conference on New interfaces for musical expression*, National University of Singapore, Singapore, Singapore, pp. 109–115.

11. Franinovic, K. (2008) "Basic Interaction Design for Sonic Artefacts in Everyday Contexts". *Focused - Current Design Research Projects and Methods*. Swiss Design Network Symposium, Bern.

12. Svanaes, D. (2000). *Understanding Interactivity - Steps to a Phenomenology of Human-computer Interaction*. Ph.D. in computer science, NTNU, Trondheim.

Recently, Lim and colleagues extend this research by identifying a number of attributes of an interaction gestalt. Among others, these include pace (from fast to slow), resolution (scarce to dense), speed (delaying to rapid), state (fixed to changing) and time-depth (concurrent to sequential). The explanatory diagram they use (fig. 1) shows that interaction gestalt and its attributes are placed in-between the user experience, expressed through qualities such as fun, ease of use and pleasantness, and the interactive artifact, defined by its physical properties including size, structure, texture and arrangement. They suggest that designers need to acquire an understanding of how to handle interaction gestalt attributes in order to be able to create the desired user experiences. However there is no clear discussion of how the process of shaping, describing and analyzing such interaction gestalts should proceed.

Basic Design Methodologies

Basic interaction design can manifest itself in process-oriented exercises or methods that designers can use to explore new ideas. For example, Hallnäs and Redström used abstract information appliances (objects without functionality) in their methodological exercises to invent novel interactions[13]. Their Shaker artifact was described as "A black box the size of a small book that makes a sound as it is shaken". By adding functionality, the authors conceptualized a new kind of keyboard in which one has to shake the black box rather than type. Rather than resulting in a set of interaction gestalt attributes, these exercises provide useful procedures for exploring and shaping them.

In an ongoing interdisciplinary project, the author has been further investigating basic design as a link between scientific and design methodologies[14]. The project is a collaboration between interaction designers and sound perception psychologists, aimed at studying simple relationships between actions performed with an object and interactive sounds associated to them. The objects in question were designed around experimental tasks that can be measured in laboratory setting. We describe these creations as abstract sonic artifacts. They are the final result of a field study that was conducted in a domestic kitchen, in combination with a number of constraints arising from the requirements of the experiments. The kitchen was chosen because it abounds with manual tools, such as knives or spoons, and with mechanical tools with moving parts, such as garlic squeezers. In these experiences, the manual operation responsible for generating sound is transparent, as the action and its effect are directly linked, and this property was intended to be preserved in the subsequently designed artifacts.

We adopted early basic design strategies such as reduction and abstraction from everyday contexts in order to draw our design material from real situations[15]. By engaging with existing phenomena, rather than relying on predefined taxonomies of sounds or actions, we were able to acquire tacit knowledge of the design materials. This knowledge was used to generate a number of concepts, each of which represented a salient feature digested from an experience documented in field study and abstracted from its functionality. For example, the Twister is an artifact that derives from the action of twisting a stove top expresso machine and the Crush from the action of compressing plastic bottles for recycling (fig. 2). In addition to specifying an interactive experience, an experimental task was also outlined serving as a starting point for a dialog with psychology researchers on the development of perceptual evaluations of the artifacts.

13. Hallnäs, L. and Redström, J. (2002), "Abstract Information Appliances: Methodological Exercises in Conceptual Design of Computational Things", in *Proc. of Designing Interactive Systems*, pp. 105–116.

14. Abstract sonic artefacts were developed together with Yon Visell, who together with the author, leads interaction design research of the European Commission project called CLOSED: Closing the Loop of Sound Evaluation and Design of the FP6-NEST-PATH "Measuring the Impossible" at Zurich University of the Arts. They collaborated with psychology researchers Guillaume Lemaitre and Oliver Houix from Sound Design and Perception group at Institut de Recherche et Coordination Acoustique/Musique.

15. An in-depth discussion of the design process can be found in K. Franinovic and Y. Visell "Strategies for Sonic Interaction Design: From Context to Basic Design". *Proc. of the 14th International Conference on Auditory Display*, Paris, 2008.

2a

2b

2. Twister and Crush shapes reflect the actions that are performed with them.

4a

4b

4. Spinotron prototype enabled psychological experiments on sound and action.

These ideas were developed into a set of working prototypes –abstract forms embedded with computing and sound that afford simple manual interactions, such as squeezing, pushing or twisting (fig. 3). While being manipulated, the objects respond with continuous sonic feedback. The Spinotron object was chosen for further evaluation in a laboratory setting (fig. 4). The object affords pumping actions that cause a virtual wheel to rotate, and, in turn, to generate the sound of a ratcheted flywheel mechanism, similar to the freewheel of a bicycle. The first results from the experimental evaluations indicate that people perceive the cause of the sounds differently when they are producing the sound and when they listen to the same sounds without the embodied experience. In addition, the study suggests that continuous sonic feedback coupled to gesture was successful in aiding users in controlling the object and accomplishing the given tasks.

The methodology that was used for designing these abstract sonic artifacts extended the diagram proposed by Lim and colleagues via processes that can be used by designers in order to understand, explore and create with interactive attributes. This methodology can be summarized as follows (fig. 5):

- Select an existing setting that abounds with relevant interactions and document them
- Analyze, describe and abstract from everyday experiences

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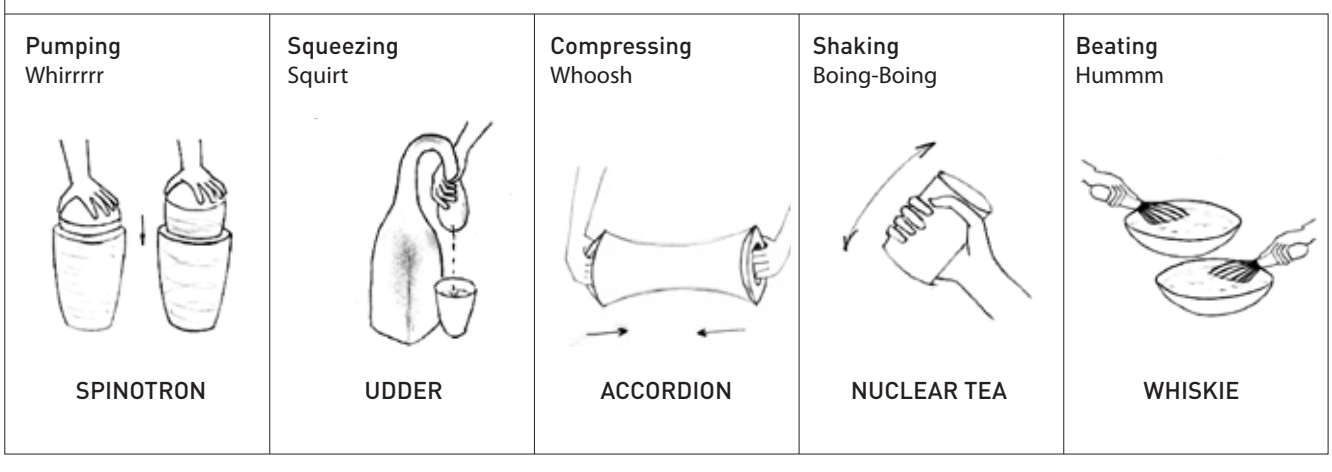

3. Sketches of several concepts for abstract sonic artifacts.

- Shape and combine found materials in order to create new artifacts
- Perform evaluation of designed objects
- Further, this project showed how basic design methods can become useful tools for interdisciplinary research.

Conclusion

During my studies in interaction design, Gillian Crampton Smith, then director of the Interaction Design Institute Ivrea, was known for her reminders about the need to consider both "designing the right thing" and "designing the thing right." The HCI community has given much attention to the first part of her advice. Rightly, ethnographic research, techniques borrowed from theatre or cultural studies have become an integral part of HCI research and practice. The second part of Crampton Smith's admonition, however, still remains an obscure part of interaction design process, often associated with an inexplicable creative spark.

Here, I have discussed the analytic and creative methods of Basic Interaction Design, which may offer an opportunity to better understand qualities that shape an aesthetic experience in interaction. This may allow designers to become more familiar and aware of their creative practice and of the aesthetic choices they make. As they are mastering their materials, they must not forget to consider the personal, social and cultural experiences that their products might engender. Because, if Svanaes had performed his interaction gestalt experiments a few hundreds years ago, the gestalt that was identified by its participants would certainly not have been - "the light switch"!

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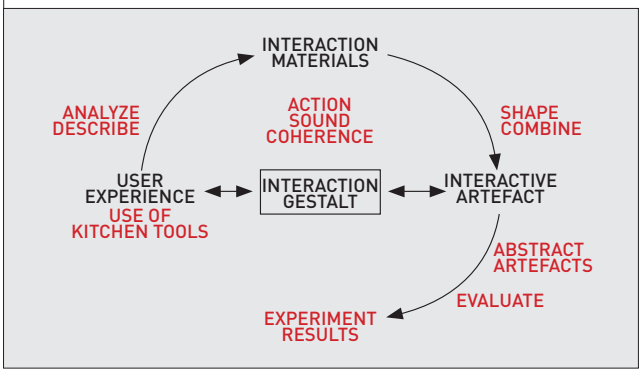

5. The methodology for the design of abstract sonic artifacts as it extends the diagram by Lim et al.